REMARKS

In response to the Office Action mailed May 13, 2003, Applicants submit the following remarks regarding the Examiner's rejections with respect to claims 1, 3, 9, 14, 17, and 21-24 as being indefinite under 35 U.S.C. § 112(2); claim 26 as being anticipated under 35 U.S.C. § 102(b); and claims 1-12, 14-15, 17, and 21-25 as being obvious under 35 U.S.C. § 103. Claims 1-12, 14-15, 17, and 21-26 are pending in this application. Applicants submit that the pending claims, as amended herein, combined with the remarks below place the application in condition for allowance.

Applicants above have amended the specification and figures to reflect that what was previously referred to as "radial axis r" should instead be referred to as "longitudinal axis L." As best illustrated in Figure 2, which is a diametric cross-section of an embodiment of the invention, "longitudinal axis" is a more appropriate term. The Replacement Sheets for Figures 2-4 are attached hereto.

Rejection of Claims 1, 3, 9, 14, 17, and 21-24 under 35 U.S.C. § 112(2):

The Examiner has rejected claims 1, 3, 9, 14, 17, and 21-24 as being indefinite under 35 U.S.C. § 112(2). The Examiner states "[a] broad range or limitation together with a narrow range or limitation that falls within the broad range or limitation (in the same claim) is considered indefinite." *Citing Ex parte Wu*, 10 USPQ.2d 2031, 2033 (Bd. Pat. App. & Inter. 1989). The Examiner explains that claims 1, 9, and 17 recite "the linear cross-sectional profile being angled between 40 and 68 degrees from the coupling axis" whereas the dependent claims 3, 14, and 22 recite "wherein the linear cross-sectional profile is angled between 50 and 59 degrees from the coupling axis."

Applicants respectfully disagree with the Examiner's reasons for the Section 112 rejections. It is the Applicants' understanding that "it is not improper under 35 U.S.C. 112, second paragraph, to present a dependent claim that sets forth a narrower range for an element than the range set forth in the claim from which it depends." MPEP § 2173.05(c). The narrower ranges claimed by Applicants are set forth in dependent claims, and they all fall within the broader range recited in the respective independent claim. The Examiner even stresses that the

broad and narrow limitations must not occur "in the same claim." The MPEP clearly allows a narrower range in a dependent claim as one method of claiming a specific embodiment. Applicants further submit that the specification describes one such preferred embodiment (page 5, lines 14-17).

In addition, the Examiner's reliance on *Wu* is readily distinguishable from the present case. In *Wu*, the issue before the Board did not involve numeric ranges; instead the applicant and the Examiner debated whether the term "optionally" was indefinite. The Board examined several variants of exemplary claim language, for example, "such as," "optionally," up to," and "not more than." The Applicants have not used any exemplary claim language and do not view the facts of *Wu* as having particular relevance to the present case. Consequently, the Applicants submit that the recitation of a broad range in its independent claims and a more narrow range in its dependent claims is an acceptable and permitted practice that does not make the subject claims indefinite. Thus, Applicants request that this rejection under Section 112 be withdrawn.

The Examiner further rejects claim 17 because the phrase "the tapered mouth" lacks antecedent basis, and further because the phrase "of a like metallic material" is considered to be indefinite. Applicants have amended claim 17 to provide antecedent basis. Applicants also submit that the phrase "of a like metallic material" is sufficiently defined in the specification and therefore not indefinite. A word of degree may be used in a claim if the patent's specification provides some standard for measuring that degree. *Seattle Box Co., v. Industrial Crating & Packing, Inc.*, 731 F.2d 818, 826, 221 USPQ 568 (Fed. Cir. 1984). The standard for measuring is whether one of ordinary skill in the art would understand what is claimed when the claim is read in light of the specification. *Id.* Applicants' specification provides that "each of the components in the assembly 100 can be manufactured from like materials, such as stainless steel." One skilled in the art will appreciate that the term "like" refers to materials having similar material properties, for example, strength, density, modulus of elasticity, etc. Accordingly, Applicants request that the Examiner reconsider and withdraw the rejection of claim 17, as amended.

Rejection of Claim 26 under 35 U.S.C. § 102(b):

The Examiner has rejected claim 26 under 35 U.S.C. § 102(b) as being anticipated by Hashimoto, U.S. Patent No. 5,172,939. Hashimoto discloses a method of coupling a branch pipe 5 with a main pipe 1 where the longitudinal axes of the pipes are substantially orthogonal to each other after installation is complete (Figures 1-10 of Hashimoto). Hashimoto does not teach or suggest aligning the longitudinal axes of each pipe. Hashimoto is primarily directed at achieving a sufficient contact state between the branch pipe 5 and the main pipe 1 in the event the branch pipe 5 is initially installed at an inclined state (column 5, lines 14-27).

Conversely, Applicants' claim 26 states that "abutting the first component against the second component with their longitudinal axes aligned." The feature in claim 26 of the longitudinal axes being aligned precludes a rejection under Section 102(b). In addition, Applicants have amended claim 26 herein to add the feature of "providing a first component having a first longitudinal bore and a first tapered engagement portion with a linear cross-sectional profile that is symmetrical about a first longitudinal axis and angled between 40 and 68 degrees therefrom." Applicants submit that claim 26, as amended, is novel and therefore allowable over Hashimoto. Further, Applicants' claim 26 is also non-obvious in view of Hashimoto, as discussed in detail below.

Rejection of Claims 1-12, 14-15, 17, and 21-25 under 35 U.S.C. § 103(a):

The Examiner has rejected claims 1-12, 14-15, 17, and 21-25 under 35 U.S.C. § 103(a) as being obvious in light of Hashimoto, U.S. Patent No. 5,172,939 with secondary reliance on Mott et al., U.S. Patent No. 4,817,962; Sugino et al., U.S. Patent No. 6,045,165; and Kato, U.S. Patent No. 5,667,255. In particular, the Examiner submits that the linear cross-sectional profile (or tangential contact angle) range of 40-68 degrees from the coupling axis claimed by Applicants is obvious based on the range disclosed in Hashimoto of $0.4D \leq \gamma \leq 10D$, where "D" is the diameter of the branch pipe and "γ" is the radius of curvature of the branch pipe pressure bearing surface 18. The Examiner cites *Aller* for the proposition that it would have been obvious to one having ordinary skill in the art at the time the invention was made to employ said range in Hashimoto, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering optimum or workable ranges involves only routine skill. *In*

re Aller, 105 USPQ 233, 235. The Examiner further opines that "Hashimoto contemplates and finds import in the angle of contact between the fitting (5) and the vessel (1)."

As an initial matter, Applicants would like to clarify the holding in *Aller*. In *Aller*, the main issue was whether the ranges claimed by the applicant with respect to temperature and acid concentration, which were close, but not overlapping with the prior art, were obvious to one skilled in the art. *Id.* at 234. The court held that normally, a change in temperature, concentration, or both would be an unpatentable modification. *Id.* at 235. However, even these changes may be patentable if the particular ranges claimed produce a new and unexpected result that is different in kind and degree from the results of the prior art. *Id.* at 235 (such ranges are termed "critical ranges"). The court did caution that if the effort in finding the so-called "critical ranges" was within the capabilities of one skilled in the art, then these ranges will not be patentable. *Id.* Further, it is not inventive to discover the optimum or workable ranges by routine experimentation. *Id.* Consequently, *Aller* does not render all "critical ranges" as unpatentable, only those ranges developed through routine experimentation by one skilled in the art. As will be discussed in more detail, Applicants' experiments were not suggested by the prior art teachings and were far from routine. The combined skill and knowledge of several individuals highly skilled in the art was required to develop the ranges, and the Hashimoto disclosure, in particular, was irrelevant with respect to at least one of the new and unexpected results produced by the subject application, namely to substantially decrease relative motion between the high-pressure sealing components.

Applicants first submit that the range identified in Hashimoto is directed toward a completely different feature than Applicants' range. As discussed in the Hashimoto abstract and illustrated in Figure 3, the Hashimoto range is directed to the radius of curvature "r" of the spherical face of the contacting surface (18) of the branch pipe (5). On the contrary, as recited in Applicants' claims and shown in Figure 3, Applicants' range is directed to the angle of the linear taper, "α." The difference is significant, as the rounded contact surface (18) of the branch pipe (5) does not dictate the tangential contact angle since this can only be dictated by varying the receiving bearing surface (3') of the main pipe (1) in Hashimoto. Therefore, Hashimoto does not suggest, teach, or even discuss varying the tangential angle of the main pipe (1). Further,

Hashimoto does not suggest experimenting with the angle of the linear face or with the tangential contact angle. Accordingly, Applicants' invention is patentable under Section 103(a) over the cited combination.

In further response to the Examiner's rejection and reliance on *Aller*, Applicants submit the declaration of Jordan J. Hopkins, a named inventor in the subject application, attached hereto as Attachment 1. Mr. Hopkins is an expert in "designing, analyzing, and testing ultrahigh pressure vessel systems and components." Hopkins Decl., page 1, ¶ 3. In addition, Mr. Hopkins is familiar with the prosecution history of the subject application and the references cited by the Examiner. Hopkins Decl., page 2, ¶ 4. Based on Hashimoto and the other references, the inventors had "no reasonable expectation that [they] would successfully achieve an effective sealing configuration." Hopkins Decl., page 2, ¶ 7. Mr. Hopkins and his coworkers found that "[o]nly after many experiments and finite element analysis modeling did we find that the inventive angle of the mating surfaces relative to the radial axis could substantially reduce, if not eliminate, any relative motion between the components during pressure cycling." Hopkins Decl., page 2, ¶ 7. Figure 5 of the subject application, attached hereto as Attachment 2, supports that many experiments were needed to hone in on the desired "critical range." Further, the results obtained were both new, unexpected and were different in kind and degree from the results of the prior art. This certainly meets the requirements for patentable subject matter under *Aller*.

In addition to the above remarks, Applicants respectfully disagree with the Examiner that Hashimoto contemplates and finds import in the angle of contact between the fitting (5) and the vessel (1). As pointed out by Mr. Hopkins, "Hashimoto's teaching that the curvature radius of the pressure bearing surface (18) is to be within a range of $0.4D \leq g \leq 10D$ (column 3, lines 31- 42) is merely to ensure that the curvature radius is large enough to withstand the force (tightening torque) exerted from the nut (7), that is, the force transmitted by the terminal end of the branch pipe (6) is sufficiently distributed over the pressure receiving bearing surface (3') of the main pipe (1)." Hopkins Decl., page 3, ¶ 9.

Thus, the teaching in Hashimoto, even when combined with the other cited references, does not teach or suggest (1) that the inventors even experiment with the angle of the linear taper, or (2) that the range claimed by Applicants, or a similar range for that matter, could

result in reduced relative motion between the sealing components. Thus, the critical range developed by Applicants is new, unexpected, and different in kind and degree from the results of the cited prior art and therefore amounts to patentable subject matter.

Accordingly, Applicants have developed and claimed a critical range to substantially reduce relative motion between the sealing components of an ultra high-pressure system. This claimed feature, among others, renders the independent claims 1, 9, 17, and 25 non-obvious and patentable over the prior art. In addition, all claims depending from the aforementioned independent claims are also allowable.

The Commissioner is authorized to charge any additional fees due by way of this Amendment, or credit any overpayment, to our Deposit Account No. 19-1090.

All of the claims remaining in the application are now clearly allowable. Favorable consideration and a Notice of Allowance are earnestly solicited.

Respectfully submitted,

Jordan J. Hopkins et al.

SEED Intellectual Property Law Group PLLC

Kevin S. Costanza
Registration No. 37,801

KSC/RCV:ljs

Enclosures:
Postcard
Attachments 1 and 2
3 Sheets Replacement Drawings (Figs. 2-4)

701 Fifth Avenue, Suite 6300
Seattle, Washington 98104-7092
Phone: (206) 622-4900
Fax: (206) 682-6031

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